DOCUMENT RESUME

ED 253 110 FL 014 858

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TITLE The Role of Language in the Development of Intelligence: Vygotsky Revisited.
PUB DATE Dec 83
NOTE 35p.; Paper presented at the Annual Conference of the American Educational Research Association (68th, New Orleans, LA, April 23-27, 1984) and adapted from a presentation at the Forum for Interdisciplinary Studies on Language Policy and Social Problems (Curacao, Netherland Antilles, December 1983).
PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Processes; *Intellectual Development; *Language Acquisition; Language Processing; *Language Role; Linguistic Theory
IDENTIFIERS *Vygotsky (Levs)

ABSTRACT

Vygotsky's views on how language is instrumental in bringing about advanced forms of intellectual functioning offer a researchable framework from which to study this development. Developmentalists in psychology and linguistics have focused for too long on continuities rather than on the process of change in mental growth. The study of the emergence and development of higher order intellectual processes holds the most promise of all of the scientific inquiries. The heuristic value of Vygotsky's theory lies in the potential for research on specific processes that influence intelligence. In the future, this knowledge could be applied in understanding different areas of exceptionality. It is a theory that addresses the complexity of interactions among developing biological, linguistic, and cognitive functions and provides a unique way of conceptualizing complex aspects of intelligence. (MSE)

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The Role of Language in the Development of Intelligence: Vygotsky Revisited

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Running head: THE ROLE OF LANGUAGE

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This paper is adapted from a presentation given at the Forum for Interdisciplinary Studies on Language Policy and Social Problems. Curacao, N.A, 12/1983.

Abstract

This paper presents a review of some of Vygotsky's views on how language is instrumental in bringing about advanced forms of intellectual functioning. The ontogenesis of higher order cognitive processes is considered to be precipitated, not simply by biological processes, as seems to be the case for simple types of learning. Rather, communication patterns in a given socio-historical context play a major role in the individual's intellectual development. Vygotsky's theory presents a challenge to present Piagetism and psycholinguistic theories about development. At the same time, it provides a theoretical alternative to traditional conceptions about intelligence that are based on "guesses" about the role of heredity and biological maturation with regard to the development of higher order psychological processes and skills.

Introduction

What do children learn when they communicate with adults and older peers? Do they learn primarily facts and language? Are they learning how to think? Is it likely that some children develop intellectually faster than others as a function of how language is used around them? Should group differences in intelligence be regarded mainly in terms of differences in genetic endowment as many believe presently, or can they be explained in terms of past and present communication experiences?

These questions are often subject to speculation and remain largely unaddressed theoretically. Vygotsky's theory of cognitive development is relevant in this regard but has not been made explicit to educators. The purpose of this paper is to familiarize readers with his views on verbal regulation of thinking skills, to describe related research and applications of the theory and to explore its relevance for researchers, parents and educators.

Overview of the Theory

Vygotsky's work in the 1920's and early 1930's has only recently received recognition in the West. He died early (1896-1934); yet his students, the most influential of whom is A. R. Luria, forged a new direction in several branches of psychology. Although the focus of this work is different from Piaget's, he delineated a stage theory of cognitive development which has received substantial support. Vygotsky's focus was on uncovering the social basis of higher cognitive processes or logical thought. Rather than

attributing the qualitative progression of cognitive processes primarily to maturation, he sought to understand how social conditions and human interactions affect thought. In other words, he theorized about the environmental and communication processes that mediate within and between stage development. His ideas represent a new approach in current cognitive developmental theories in the West.

Philosophical Antecedents to Learning Theories

Three philosophical approaches can be related to current psychological models regarding intellectual development. The issue of how humans attain complex cognitive functions is an old one and concerns how we learn about the world around us. First, current behaviorism's roots can be traced to Locke and Hume, who believed our knowledge stems from the connections made between our senses and the environment. Sensations are built into our blank slates from birth through experience. According to this model, higher forms of thought are developed cumulatively through simple associations learned through experience. Behaviorists postulate continuity between simple and complex learning by postulating chaining and shaping processes.

Second, the most influential developmental theory today is that of Jean Piaget, whose work was influenced strongly by Kant and Russell (1914). In explaining the acquisition of complex psychological processes such as logical operations, the behavioristic position soon proves inadequate. Although knowledge

acquired through sensation is a prerequisite for higher mental processes, the development of the latter requires active restructuring on the part of the learner. The capacity for restructuring experience and for attaining consciousness of information that is not based directly on sensory experience represents a human information-processing accomplishment left unaddressed by behaviorism. Kant's ideas about how knowledge is organized were reflected in Piaget's writings concerning the origin and development of higher order operations and concepts (Case, 1973). In effect, Piaget's theory rejected the associationist explanation for the origination of complex knowledge such as concepts of truth, causality, self and other awareness, and metacognitive processes. This type of learning is not subject to learning by association any more than "deep structure" is in Chomsky's (1959) writings. Piaget's genetic epistemology (i.e. interest in the origin and development of knowledge) leads one to conclude that while sensory learning is a prerequisite to advanced thought, biologically-determined structures that are influenced by maturation processes are the primary causes of higher mental processes, a view shared by modern psycholinguistic theory (Chomsky, 1975; Lennenberg, 1967).

Vygotsky's approach, which will be referred to here as verbal regulation theory, is largely compatible with and influenced by Marx's materialistic philosophy. Since Descartes, many psychologists have regarded self awareness and higher cognitive

operations as irreducible, prewired properties of the human intellect, while neglecting the role of environmental processes in their ontogenesis. In contrast, Vygotsky views the problem as one rooted primarily in man's social historical development. That is, complex mental processes are considered to be formed and guided by social conditions and interactions. Support for this view is found in research with young children and different cultural subgroups (Vygotsky, 1978) which is discussed at a later point.

The Soviet theorist's focus is in how physical maturation and related sensory-motor based learning interact with environmental processes to produce complex, abstract learning. His conceptualization of the ontogenesis of higher-order cognitive skills can be described as follows: Complex cognitive functions (or operations according to Piaget) are viewed by Vygotsky as requiring internally produced mediation that changes structurally throughout development. They <u>also</u> develop as a function of socio-historical conditions that determine, in part, the organization of experiences the child will have and the information - processing strategies he will employ. By the term historical, Vygotsky refers to man's access to symbolic and physical "tools" that have been developed earlier in time. Hence, intellectual potential is not "caused" and developed mainly through biological maturation but rather, through man's accumulated knowledge and communication patterns present in his environment. Children's cognitive development is regarded as determined, initially, through biological processes and guided

subsequently by social interactions with adults. Adults initiate and mediate, via social interactions, the development of children's cognitive skills and behavior. Later, as children develop, they internalize adult-provided operations and verbal directions in guiding their own thought. This is the way "historically determined and culturally organized ways of operating on information" (Vygotsky, 1978, p.21) influence the individual's knowledge and awareness of self and the world.

Current Developmental Models

In the next section, an overview of intellectual development models is presented to provide a context from which the reader can understand Vygotsky's unique approach. Bruner's (1973) views on cognitive development are similar to Vygotsky's in the emphasis given to the role of the social field into which the individual is cast. For example, the development of human communication proceeds from enactive, sensory-motor expressions that are based on social norms to iconic and symbolic forms that also share common semantic meanings. Bruner observed how pointing/gesturing gives way to labeling and finally to sentential use as a sequence in human communication. Such modes of communication depend on social interaction for refinement and development (Riegel, 1976).

Modern psycholinguistic theory has shown an invariant sequence in development where the individual begin communication through morphememes, holophrases, telegraphic speech and picot words all the way up to expressing thought in complex sentences. This universal

pattern, like that of Piaget's cognitive development is clearly a function of a species-specific, maturational processes. However, its biological foundation is by no means explanatory of the acquisition of higher-order psychological processes. Maturational approaches to the problem, like those prevalent in cognitive psychology, tend to over-emphasize intra-individual processes without adequately studying the impact of the social environment in "what" develops (Siegler, 1978). Vygotsky preceeded Kurt Lewin in orienting psychology towards an ecological perspective in understanding learning, that quintessential form of behavior. Biological maturation and heredity need not be regarded indiscriminately as the critical variables in understanding individual and group differences in development. Cognitive development is a dynamic process subject to structural change through learning. It is ironic that the human brain's intellectual potential tends be underestimated largely on the basis of existing age norms. Yet, those norms may reflect normative learning environments that are not necessarily constant. Precocity, for example, is regarded from this perspective, thus not as an anomaly in developmental principles, but mainly as the result of optimal person/environment interactions.

Application of Theory

Vygotsky would argue that an over-emphasis on matching instructional content in reading, writing and arithmetic with specific age levels now prevails in education. Piaget's work has

been translated often in a way that attention to developmental stages has taken precedence to that of developing learning potential per se. From an evaluationary perspective, maturation-based stages may represent or serve to index age norms in a given socio-cultural space and time. Vygotsky (1978) notes that there are 3 major types of theory relating development to learning, each of which has impacted on education. In the first one, development is considered mainly as a maturational process that determines learning and which is not, in and of itself, a function of learning. Vygotsky describes this position as one where "learning forms a superstructure over development, leaving the latter essentially unaltered" (p. 80) and reflects, in part, the gist of Piagetian, psycholinguistic and behavioral genetic approaches. According to the second one (behaviorism), learning is development (development representing the accumulation of all learned responses). Within gross biological parameters, development occurs simultaneously with learning rather than preceding it. The last model suggests that development and learning are two independent processes which interact in such a way as to affect each other. That is, learning causes development and vice versa, since learning itself is a developmental process. Biological development depends on the central nervous system directly and makes possible particular learning processes. Learning, in turn, increasingly advances intellectual development.

Vygotsky (1978) rejects all three theoretical approaches,

although he recognizes that learning and development are interdependent and make each other possible. His model attempts to tackle the question concerning the interaction between the two processes by drawing attention to the role of a third developmental process - that of language competence. In doing so, he notes that traditionally we have only focused on children's actual developmental level as measured by standard testing procedures. Vygotsky argues that a second level of development exists which is of equal, if not greater, importance than the first. It is the zone of proximal development and refers to "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). For example, two children who have the same I.Q. would appear comparable in terms of maturation and previous learning for their age but could differ considerably in terms of subsequent learning capabilities at the next age level. Vygotsky argues that learning activates developmental processes that become functional, initially, through social interaction with more advanced individuals. This view suggests that intelligence can be operationalized by focusing on learning ability as opposed to previous learning, as has been the case.

For Vygotsky, learning precedes intellectual development rather than coinciding with, or being a function of development. The zone of proximal development serves as an index of developmental

functions that are in the process of completion. It is a concept that can be used to track how external information is organized by the child and to assess his level of intellectual functioning, something which is crucial for effective teaching. Hence, by concentrating our diagnostic methods on what the child can do with and without external guidance, we can obtain relevant information for instructional design and individual assessment. Anomalies in intellectual ability and development, such as precocious, gifted and talented children, as well as idiot-savants and some types of learning disabilities are subject to various interpretations, depending on one's theoretical position, Vygotsky's seminal ideas about development show their value in helping to explain evidence of exceptional abilities as well as generating hypotheses regarding inconsistencies found in Piagetian theory (Bower, 1977; Dasen, 1974). That is, qualitative differences in children's social environments can be postulated in each of the above cases. Although new research is emerging to address some of these problems (e.g., Frauenglass & Diaz, 1984; Wertsch, 1980), current developmental research methods may require further evaluation to support Vygotsky's theory. Presently, new developments in the study of accelerated learning (Lozanov, 1978; Stein, Hardy, & Totten, 1982) and giftedness (Coangelo, 1984; Feldman, 1984; Siegler, 1978) suggest that the socio-cognitive environments to which children are exposed to regularly may influence development.

Development of Intellectual Skills

Vygotsky's verbal regulation theory concerns the processes by which adult- child verbal interaction leads to complex mental functioning. Developmentally, the child's cognition is mediated or regulated largely by adult's speech and behavior until gradually, the child achieves self-regulation. For example, when a mother shows a two year old child an object and says "hot iron," her pointing and speech will eventually cause a modification in the child's perception and cognition. The mother's pointing gesture and speech serve as external signals which will alter the way the environment acts upon the young child around age two. In time, the child begins to point and name objects in a similar manner and thus acts upon the environment that influences her. Through speech, the range and intensity of stimuli acting on the individual is modified. According to this view, the capacity for abstract, propositional thought is developed also through consistent patterns in other-regulation.

The relation between external speech and mental activity changes developmentally. Around age three, speech is often observed to accompany children's behavior. After some time, speech begins to precede their behavior and is considered to have a planning function. This shift is geared to mark the formation of new functional systems that is characteristic of complex cognitive activity.

After age six, Vygotsky noted how children's external speech

soon became fragmented, replaced by whispering and eventually disappeared. In Piaget's early work, the latter sequence was considered simply as egocentric speech which disappeared with maturation. Vygotsky's explanation for this is that the child's external speech, rather than being egocentric, is functional in guiding the child's activities. Rather than disappearing, external speech becomes internalized as an integral, directional aspect of higher mental processes. Inner speech, which denotes self-regulation, is considered to be a socially-influenced characteristic of cognitive activity.

Skills in speech are critical to thinking. Research in this area shows that, when a person is confronted with difficult problem solving situations, he often reverts to whispering and external speech (Vygotsky, 1962). The intensification of speech in such situations serves to illustrate the role of speech in mediating and facilitating cognitive activity. Again, this use of language for information-processing and problem-solving purposes originates from cumulative, didactic social interactions.

The child's knowledge about what he needs to have access to in order to perform a complex task can be regarded as an example of a higher mental function. In exploring the conditions leading to the development of such, Vygotsky (1962) noted " any function in the child's (cultural) development appears twice, or on two planes. First . . . on the social plane and then on the psychological plane. First it appears between people as an interpsychological

category and then within the child as a intra-psychological category. This is equally true with regard to voluntary action, to logical memory, to the formation of concepts and the development of volition". How speech is used in social interactions thus will play a crucial role in the formation and organization of higher mental operations on the individual plane. One of the contributions of Vygotsky's theory is in providing a framework from which to examine how the child may achieve increased levels of cognitive sophistication or information processing. Most research and theory has focused mainly in showing differences in ability across age groups where children perform independently of external help. The context through which development of these higher-order functions take place, however, has not been accorded as much importance until recently.

One of the ways Vygotsky sought support for his theory was to study differences in cognitive functions across various levels of social cultural development. He initiated research comparing populations which differ in terms of dominant types of activity before cross cultural studies became a popular branch of psychology. Vygotsky considered the parallel between individual and cultural development in cognition. Contrary to Hall's" ontogeny recapitulates phylogeny" principle, Vygotsky's research supported the thesis that the ontogenesis of any mental process depends on the particular socio-historical context within which the individual interacts. According to this view, biological mechanisms are

emphasized less in accounting for the origin and development of complex learning processes. Biological mechanisms are regarded mainly as carriers of intellectual potential which is directed and determined by environmental processes. Vygotsky addresses orderly changes in cognition by postulating his own stage theory of development which has already been described in depth by Stewin and Martin (1974).

Related Research

Vygotsky and his associates made use of the conditions existing in remote parts of the Soviet Union in the early 1930's which were beginning to undergo radical changes in their socio-economic system and way of life. Part of their research occurred during a period where the population of Uzbekistan was witnessing rapid reorganization of social patterns, going from a backward agricultural economy to collectivization. This was the context for studying social historical influences on cognitive processes (Luria, 1976). Perceptual and cognitive processes (e.g., generalization, abstraction, reasoning, inference, self perception) of the above illiterate group were compared with those of more educated groups. For example, categorization tasks served to show gross differences between groups in classification behaviors. The illiterate, rural group's thinking was concrete and situational, and based on practical groupings. They failed to classify by using abstract categories unlike subjects who were involved in communal work and had taken brief courses or those from urban backgrounds.

The above research supported the thesis that the structure for complex cognitive operations does not remain unaffected during various stages of socio-cultural evolution. In fact, it is considered to change as social conditions vary. Subsequent cross cultural research has supported this view (Cole and Bruner, 1973; Dasen 1974) although social conditions have been defined more in terms of educational experiences rather than as a transition to "collectivized labor and new forms of social relations".

One of the major shifts in cognitive activity is the transition from the sensory-motor to rational thought (Luria, 1976). The rationales used during categorization tasks by groups less advanced in the social historical process rests on the reproduction of individual, concrete experience. Analysis and evaluation of stimulus properties according to concepts developed "in the head" or cognitive structure are characteristic of persons exposed to the more complex functions of language in everyday interactions. Discursive and logical processes that are internally and verbally mediated allow cognitive restructuring of experience. As Luria, (1976) notes," Thus a fact hitherto underrated by psychology becomes apparent: social historical shifts not only introduce new content into the mental world of human beings; they also create new forms of activity and new structures of cognitive functioning. They advanced human consciousness to new levels" (pg. 163).

From this theoretical perspective, the origin and development of complex cognitive structures can be seen as a product of

environmental processes that, in turn, imply a more fluid conceptualization of intra-species psychobiological endowment. The function of speech in expanding and directing intellectual ability is of paramount importance. Language serves a number of functions as a signaling system: a nominative role (for objective, direct references), a semantic or conceptual role, a communicative role (syntax, phonology), and an executive role in directing and regulating sequential behavior (Beiswenger, 1968). This last aspect of the language speech system represents an important link to intellectual development. The implications of this view are many, particularly for parents and teachers interested in developing the intellectual potential of children. Intellectual growth seems to be a function of other-regulation, (also called verbal regulation), to which the child is exposed to. It follows that gross differences should be observed in language use pertaining to executive functions in information-processing between children who are considered bright or dull and their parents. This is the case in research I've conducted with elementary high and low achieving students and their parents (Portes, 1984), where intellectually advanced children were found to engage in egocentric speech more than low achieving children when confronted with difficult problems. Past research has already shown gross differences in terms of content and quantity in the interactions of low and middle SES families. Other-regulation helps the child learn how to learn by modeling strategies for understanding information and using it to solve problems

(Frauenglass & Diaz, 1984). Verbal directions can shape thought processes, making the latter less concrete and more flexible. If the theory is correct, one would expect that children who perform poorly on cognitive tests would improve if exposed to the type of verbal regulation that brighter children receive. The following studies support this hypothesis.

Schubert and Cropley (1972) compared the verbal regulation behavior and I.Q. of Canadian Indian, and White children (grades 4-7). They found that in spite of the markedly lower I.Q. shown by the socio-culturally isolated Indians, their gain scores after training in verbal regulation skills were comparable to rural and urban white children. The latter is an example of response to training research. The authors believe that increased practice of the use of the second-signal (verbal) system is required for the former group to succeed in current schools. The authors noted that school curriculum and instruction are not directly concerned with developing verbal regulation skills per se. Children who are already lagging behind and whose family and socio-cognitive environments do not foster the development of these skills are considered to be at a clear disadvantage.

Wertsch (1979, 1980) examined regulatory aspects of the mother's communication to her child in problem-solving situations. In one study, (Wertsch 1980), three groups of 2 1/2, 3 1/2, and 4 1/2 year old children were compared using both verbal and nonverbal (i.e. gazing) behaviors in a puzzle-solving task. The authors found that

differences in the children's level of performance were accompanied by different levels of mother regulation. These differences were found when the mother helped the child discern critical aspects of the task as well as in sequencing children's behavior according to adult-provided strategies. The older children were able to benefit more from instructions, thus showing that their verbal system was developed sufficiently to not only comprehend the adult messages but to direct behavior. This example of age differences in the use of verbally-mediated cognitive skill illustrates how group differences may be conceptualized.

Parents' ability to guide the information-processing of children effectively places them as metacognitive agents for their children, particularly during the early years. As Wertsch (1979, 1980) has noted, metacognitive processes extend beyond the area of memory. Parental behavior often guides the child's increasing understanding about cause-effect, goal-based actions. Parents may identify and organize relevant elements in play situations that teach the child discrimination, encoding, retrieval skills and cognitive strategies. Children learn to differentiate between the motor and verbal system gradually as adults monitor, regulate and model information-processing skills. In other words, the child learns not only language but how to use certain aspects of language to plan and achieve goal-oriented behavior. His capacity for self-regulation is developed successively by adults through social interaction. Some sub-environments are capable of providing richer regulation than

others and this has been already evidenced in observed parent-child communication patterns (Bernstein, 1961).

Self-regulation by the child is a gradual process that hinges on his assimilation of "full valued" speech, a term that refers to the ability for verbally-mediated thought to guide behavior. Whereas Piaget's theory emphasizes the biological basis of stage/structure change, Vygotsky's focus is on the nature of child-environment interaction that may serve to account for inter and intra-stage variations. Both theorists note the de-centering theme in cognitive growth. Only the latter, however, stresses the role of verbal function in facilitating the emergence of complex cognitive processes. Vygotsky's model may serve to account for gross deviations from Piaget's stage theory such as cases of exceptional children (Bower, 1977; Dasen, 1972).

Adults adjust verbal-regulation behavior according to the child's level of language development, (Shatz and Gelman, 1973) although differences in the scope and efficiency of this guidance may vary within and between groups (e.g. SES groups). Verbal regulation of thought processes takes form in the adult's requests and commands for verbal and nonverbal behavior. In goal-oriented situations where adults provide other-regulation, the child not only complies with requests but also integrates certain types of questions and propositions which, at some later point, he may use for his own metacognitive development and problem solving.

Variations in the efficiency of parental regulation may be a

function of the demands or requests on the child as well as of the adult's awareness of the linguistic and cognitive resources of the child. For example, a mother may assume incorrectly that her child understands the goal of a given task and be unable to employ effective strategies that would result in his deployment of task-relevant behavior. A child may learn that lack of adult feedback signifies (incorrectly) that his response to a situation is correct, something which may slow within-stage cognitive growth. This is a fertile area for research with acceptional students.

Finally, Hickman (1978) illustrates some interesting aspects of the mother's regulative speech functions during the adult-child interaction. For example, she distinguishes between goal-independent and goal-dependent speech by the parent in assessing the degree of verbal regulation present during adult-child interactions. Goal-independent requests require the child to have some understanding about the goal of a given play situation. Goal-independent speech serves to direct attention and facilitate the acquisition or recall a relevant concept or attribute in the child's cognition. The author notes that goal-independent messages require more self-regulation and readiness from the child (e.g., questions like, "What is the next step?").

Intellectual Development and Language

Vygotsky's view of intelligence concerns primarily a person's ability to process information in abstract verbal terms. Response to training research has produced some novel ideas about the

development of intellectual capabilities. This line of research focuses not simply on the performance of the individual on cognitive tests but primarily on performance after training or regulation. Intelligence is viewed more in terms of the individual's potential for development, as illustrated by an earlier section on the zone of proximal development, rather than prior learning. The development of complex intellectual skills and verbal propositions is facilitated, if not produced, mainly through children's interactions with adults. During infancy, interaction with the environment results in the development of a system of signals that help the child deal with physical aspects at a visual, spatial and motor level. This level of cognitive integration is called the first signal system and corresponds, incidentally, to Piaget's construct of sensory-motor intelligence. The first signal system is based on Pavlov's respondent learning model and accounts for basic stimulus-response learning processes. Basic mental structures or bonds are developed as a function of a person's interaction with his environment by matching nonverbal, sensory-motor based concepts with arbitrary sounds. The verbal or second signal system develops independently after language functions become operative. Both systems interact and serve to mediate experiences through the developmental processes of differentiation (Werner, 1948) and increased symbolic representation.

Vygotsky (1962) believed that the roots of speech and thought are independent although he notes, "at first, thought is nonverbal

and speech nonintellectual." Their lines of development eventually meet where "speech becomes rational and thought becomes verbally expressable" (Stern, 1928). Thought is not merely expressed in words but is considered to come into existence through them. As a result, certain aspects of speech are considered relevant to the development of thought processes, particularly those that are formal operational.

Vygotsky distinguishes between two planes of speech which have "their own laws of movement." One is the inner, meaningful, semantic aspect of speech while the other is external and phonetic. External speech begins with a single word, expands to include others until sentences are formed, that is, from part to whole. In contrast, inner semantic speech begins initially as an undifferentiated whole, only later to become more distinct and precise. It requires the development of increasing number of separate semantic units. As the child's thought becomes more differentiated, there is less of a reliance on single descriptors. Development of speech is related inversely to the child's cognitive development which progresses from dealing with homogeneous wholes to better defined, specific aspects of stimulus events. Initially, the two aspects of speech are fused and have been often conceptualized incorrectly as one and the same. That is, for a young child, a world's nominative (objective reference) and significative function are undistinguishable until later in the development. The word is initially understood as being part of the object it denotes and only

later does the child become able to "decenter" sufficiently to distinguish between referent and meaning. How this differentiation takes place through a number of individual-environment interactions, how such abilities denote the development of new cognitive strategies are questions addressed by verbal regulation theory.

Vygotsky considers the problem-solving and intellectual ability of the child as a function of control processes or regulatory skills learned through social interaction. The capacity for verbal regulation is seen to underlie intellectual activity. It originates external to the child during verbal and nonverbal communications with adults. Adults not only teach all aspects of language to children, but also process information for them long before they do so for themselves. In short, children's intellectual functioning is initially, other-regulated and gradually comes under their own executive control through interaction with the environment. It is in the course of the adult-child interaction that verbal regulatory processes are presented modeled, rehearsed, refined and eventually internalized. This theory carries several important implications for parent-child interaction research, especially when considering specific parental influences on children's cognitive development. Language affects intellectual development in that it provides the "tools" that make possible complex patterns of information-processing not attainable through respondent and operant learning.

Verbal regulation of behavior is an important function of speech

that has not been studied systematically in considering environmental influences on children's intelligence. Vygotsky's views suggest that certain aspects of verbal interaction may transform the child's capacity to learn from experience. Subsequent development of self-regulated speech thus allows the individual to "prefigure and control future sequential behavior" (Beiswenger, 1968). Complex intellectual behavior involves the ability to act based on some prior intentional plan that is, to a large extent, abstract and verbally mediated. In sum, verbal regulation processes are viewed to underlie the ability to think in increasingly abstract terms and they are learned mainly through social interaction. Consequently, they merit increased research attention as a major source of variation in intellectual development.

Finally, a major emphasis of this theory concerns the ontogenesis of the capacity for verbal regulation and its course of development. Use of the "second signal system" begins by the direct regulation provided by adults to the child. Intellectual development entails transitions along different paths (e.g., conceptual, strategic and metacognitive). The child integrates various regulatory aspects inherent in the adult-child interaction (e.g., sequencing directions by the adult) gradually as a means of regulating his own cognitive behavior.

The capacity for reflective verbal thought is posited as one process in the family environment that may affect children's intellectual development. The essential aspects of language

(learning) seem fairly well distributed in children by adults and older peers except for some subcultural variations. However, it would appear that how language is used in different family and cultural settings, that is, the degree of sophistication in guiding children's information-processing capabilities and the development of concepts, could be examined more closely in future assessments of the home environment. Even within the general limits of maturation, the development of the verbal system transforms experiences to facilitate the acquisition of higher psychological processes. Both Piaget and Vygotsky have proposed a series of stages to account for discontinuities in development. The main difference between them is that Piagetian theory focuses on what changes maturationally in terms of behavior potentials or inferred mental operations. Vygotsky's is more concerned with how the social-interactive contexts may influence qualitative changes in intellectual activity. His approach is ontogenetic and serves to account for why higher levels of cognitive development (e.g., formal operations) are not achieved by adults in some cultures and also for within stage variations in general.

Vygotsky and Neo-Piagetian Theory

Currently, we have seen increased efforts to apply Piagetian theory directly to the areas of instruction and evaluation in education. Although Piaget's theory was concerned mainly with the description of cognitive operation at different periods of development, it did not address directly the role of environmental

processes in relation to changes in cognitive structure. He believed that maturation, physical and social experience, and equilibration were the main factors that affected cognitive development. The last two factors were not well defined and have received little research attention. Vygotsky's theory provides a more functional perspective with regard to the acquisition of more complex forms of thought through the psycholinguistic analysis of social experience. Certain aspects of social interaction may serve to account for how disequilibration may be induced externally to expand "the zone of proximal development." This perspective is relevant to emerging information-processing models clarifying the ontogenesis and development of metacognition via verbal interaction processes. It is also germane to some of the questions being currently addressed by neo-Piagetian theory of instruction and cognitive development. The latter attempts to provide a functional account of how the ontogenesis and development of operational structures can be influenced and assessed (Case, 1978). It postulates four major factors that affect the rate of cognitive development; size of M-power, which depends on biological maturation, degree of field independence, content-related experience and affective factors (p. 191). Vygotsky's model is particularly relevant to the third factor, content related experience, by clarifying the relationship between external guidance and the child's own repertoire of cognitive strategies or heuristics. The Vygotskian response-to-training research paradigm (e.g., Schubert &

Cropley, 1974) also appears useful in assessing of students actual and emerging levels of intellectual functioning.

Educational Implications

The preceding discussion deals mainly with the relation between learning and psycholinguistic developmental processes. According to Vygotsky, school learning activates developmental processes to a considerable extent within gross, biologically-determined parameters. Similarly, certain aspects of parent-child interaction serve a didactic purpose that is often unrecognized or confused with heredity. The theory also carries a number of implications far different from those discussed originally as illustrated below.

(a) At a time when estimates of the heritability of intelligence appear unduly exaggerated (Jensen, 1977) and views about its development remain atheoretical, the present theory warrants attention through extended research efforts on communication processes related to higher-order intellectual skills and strategies. For example, the emergence of a new cognitive strategy can be studied in the context of variations in external regulation longitudinally in ecological settings.

(b) Educational development, here and abroad, along with early age interventions, can profit from the present model. If we know more about what we want to develop and how it develops, then preschool education can be maximized considerably by training parents and teachers.

(c) Parents can be educated about optimal strategies for fostering their child's cognitive growth. Even the mere awareness that children's intellectual development is related to verbal regulation patterns may help parents and teachers become more effective and resourceful.

(d) Vygotsky's model concerning the development of higher order skills offers a fertile area for research that is germane with information-processing theory. Current models relating to the latter (e.g., Gagne', 1977) have led to a clearer understanding of how information is processed in terms of structures and stages in the human brain. However, we need more research concerning the development of cognitive strategies and higher-order intellectual skills.

(e) Sternberg (1984) has recently proposed a triarchic theory of intelligence that recognizes the importance of regulatory or executive processes in conceptualizing intelligence. Although he ignores the role of other-regulation in this respect, his model is helpful in identifying steps in information-processing that are most pertinent to intellectual performance. Yet, one area that is relatively unresearched involves the development of executive or metacognitive functions that regulate the processing of information, particularly in terms of their emergence and development. Verbal regulation theory suggests that the development of an individual's metacognitive skills is directly related to the social-interactive (other regulation) patterns surrounding him. From this perspective,

traditional I.Q. tests may be considered primarily as assessments of an individual's socio-cognitive environment rather than only of individual intelligence.

In sum, Vygotsky's views offer a researchable framework from which to study the most important type of development - that of the human mind. For too long developmentalists in psychology and linguistics have focused on continuities rather than on the process of change in mental growth (McCall, 1977). The study of the emergence and development of higher order intellectual processes holds the most promise of all of our scientific inquiries. The heuristic value of Vygotsky's theory lies in the potential for research on specific processes that influence intelligence. In the future, this knowledge could be applied in understanding different areas of exceptionality. It is a theory that addresses the complexity of interactions among developing biological, linguistic and cognitive functions and that provides a unique way of conceptualizing complex aspects of intelligence.

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